Contribution ID: **83** Type: **Talk**

CMB Birefringence Constraints on Ultra-light Axion Dark Matter

Thursday, 19 September 2024 14:15 (20 minutes)

The isotropic birefringence (all-sky rotation of linear polarization) of the cosmic microwave background (CMB) sourced by axion-like particle (ALP) dark matter is predicted to contain distinct signals from oscillating ultra-light axions at recombination as well as from local dark matter. Using Planck upper limits while incorporating allowed axion fractions of dark matter, we find strong constraints on the axion-photon coupling. These can improve over CAST limits by up to 5 and 2 orders, respectively for recombination and local dark matter axions. Forecast constraints (SO, LiteBIRD, CMB-S4, & CMB-HD) tighten further by 1-2 orders, extending to higher axion mass.

Hints of a detection (at ~3σ) of isotropic CMB birefringence from a re-analysis of Planck and WMAP data are considered, in light of our new axion dark matter signals. Certain regions of parameter space for ultra-light axion dark matter could explain this detection, if confirmed. We also present coupling constraints from searches for time-oscillation of the birefringence in the Planck data.

CMB birefringence constraints scale only weakly with ALP fraction of dark matter. They remain unaffected by uncertainties common in other astrophysical ALP probes: strength and spectrum of magnetic fields, over-density of ALPs in structures and the source's intrinsic polarization orientation.

Primary author: TRIVEDI, Pranjal (University of Hamburg)

Co-author: SIGL, Guenter (Universität Hamburg)

Presenter: TRIVEDI, Pranjal (University of Hamburg)

Session Classification: Afternoon 4